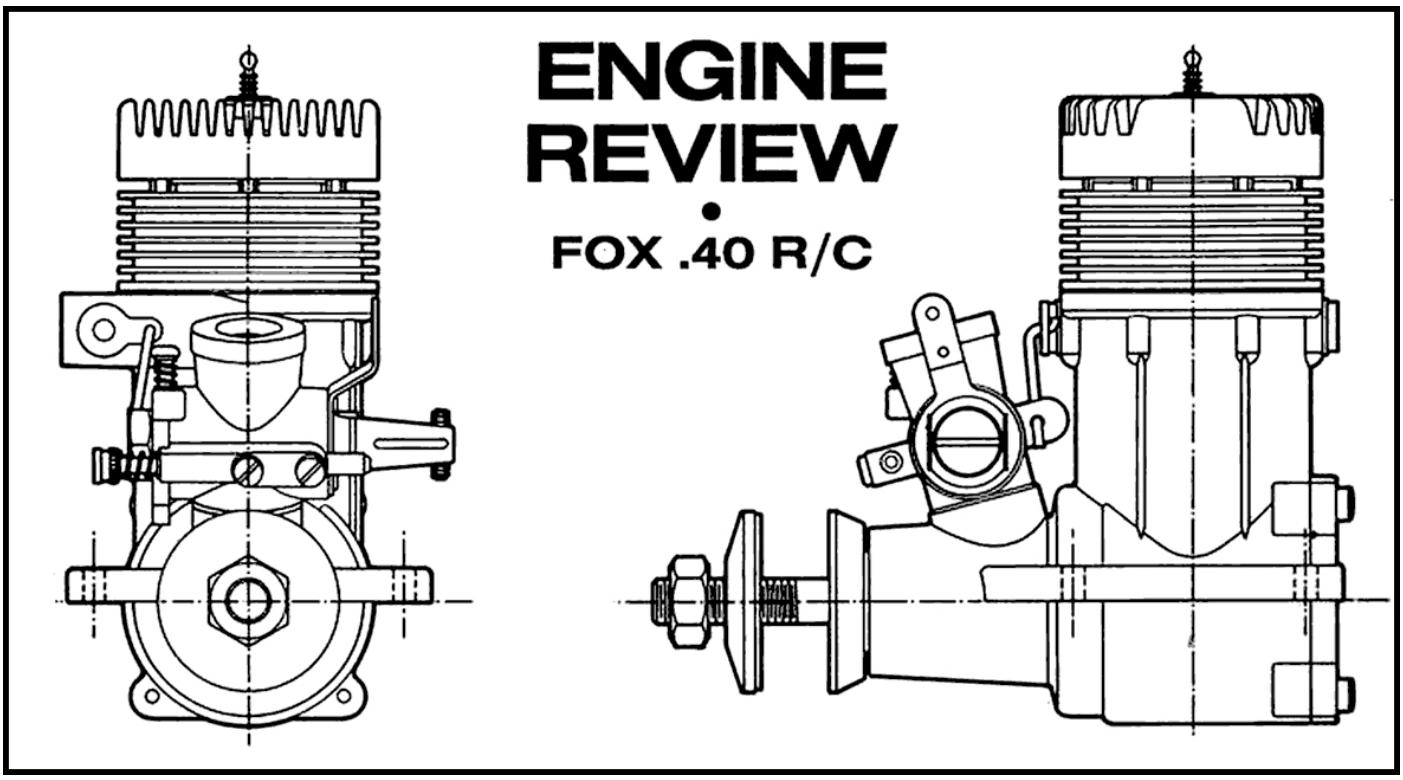
# Fox 40 R/C




**BY PETER G. F. CHINN**

**Entirely new model from one of America's oldest established engine manufacturers.**
**Design marks a breakaway from many earlier Fox traditions watch for it on the field.**

• This .40 cu. in. engine from the Fox Manufacturing Company is a completely fresh design owing little or nothing to previous medium size Fox motors.

Duke Fox's first 40 appeared 11 years ago, based on a stroked version of the 1960 Fox Rocket 35 which, itself, was designed around the 1957 Fox Combat 35 body casting. In 1962 a throttle equipped version was introduced but was made for only a short time. Subsequent Fox 40's were mostly high performance ball bearing/needle bearing engines aimed at the Control Line Rat Racing field where they were highly successful.

All these earlier medium displacement Fox motors had (and still have, in the .29, .35 and .36 models) certain features in common to wit, a single casting embracing the crankcase and cylinder casing, offset cylinder with conventional open loop or crossflow scavenging, deflector type piston and wedge pattern combustion chamber.

It is quite surprising to find that the new 40 breaks with what one had come to regard as a Fox tradition by having none of these features. In overall dimensions it is also a somewhat larger engine; taller, heavier and requiring wider bearer and bolt hole spacing.

Starting with the pressure cast aluminum main casting, this includes the crankcase and cast-in bronze main bearing bush but extends upward only so far as to include the exhaust stack. It has very long beam mounting lugs that assist in bracing the front end and extend rearward to include the thickness of the back plate thereby providing very firm support for the engine at all times. The bypass passage is divided into three parallel channels that extend almost completely around the bypass side of the cylinder sleeve. They are separated by two vertical ribs that help to align the sleeve and accommodate two of the six long 4-40 screws which, spaced at 60 degree intervals, tie the complete cylinder assembly to the case.

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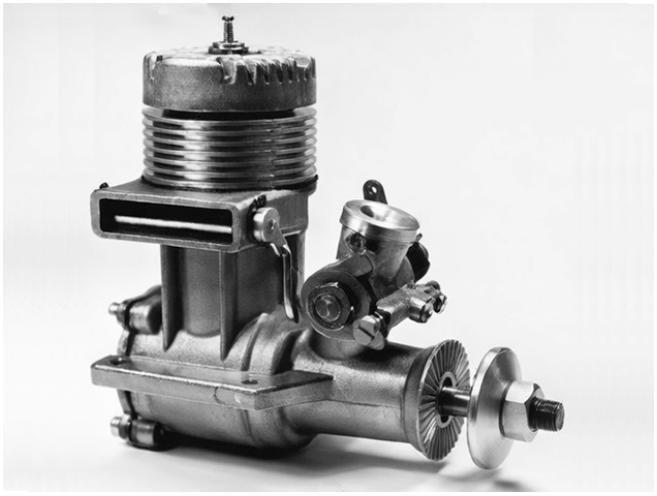


**New style porting, separate cylinder jacket and a massive shaft are features of the new Fox.**

**Like all Fox motors, 40 is easy to take apart for do it yourself servicing and examination.**

Fox engines seldom show any sort of outside influence, tending, rather, to reflect Duke Fox's own individual ideas of design, so it is interesting to note that the sleeve ports on the new 40 are just a wee bit "Garofali." The exhaust port takes the regular rectangular form but the bypass porting, consisting of two deep ports, steeply inclined through the cylinder wall and used in conjunction with a flat crown deflector less piston, are decidedly reminiscent of the system used by many of the high performance Super Tigre motors. The Fox ports are, however, modified at the top outer corners, presumably to promote a cleansing gas flow fore and aft across the piston as the port opens. Also, unlike the original non-pipe timed ST porting, there is still a blow-down period, the exhaust remaining open for 128 degrees of crank angle against a 120 degree bypass period.

Except for the absence of a baffle, the lapped piston is of orthodox Fox design, machined from Meehanite bar with an annular rib above the wrist pin bosses to help maintain roundness. Piston weight is 10.2 grams bare of 12.9 grams complete with .182 in. dia. full floating hardened tubular wrist pin. The latter is retained by wire snap rings in the piston. Incidentally, although the maker's instruction leaflet calls for extracting the wristpin if the piston and rod assembly needs to be removed from the engine, we found this unnecessary. If the rod is drawn back on the wristpin as far as it will go, it can be lifted of the crankpin and withdrawn complete with piston.

Above the exhaust stack, the cylinder is encased in a close-fitting machined aluminum finned jacket. This, aided by a gasket, seals the tops of the bypass channels and exhaust duct. The cylinder sleeve is located by the usual upper flange, on lop of which the head is seated complete with 10 thou, soft aluminum gasket. The head is unusual among present day two cycle motors in that the combustion chamber roof is perfectly flat except for a small rim surrounding the central glow plug hole. The plug fitted is Fox's highly regarded long-reach R/C type with integral idle bar.

The new 40 crankshaft, very large for an engine of this displacement, has a 9/16 in. diameter journal and an enormous (.410 bore) gas passage. The valve port, on the other hand, is of much more modest proportions and it therefore seems reasonable to suppose that the object of using a shaft of such generous dimensions is to leave plenty of scope for future development perhaps an ultra high performance version for Pylon and Rat Racing. Measured valve timing on our engine was 48 deg. ABDC to 45 deg. ATDC.

The Fox 5-A carburetor fitted to the Fox 40 R/C is outwardly similar to the Model 4-A unit first used on the Fox 36X R/C but has been completely redesigned to simplify the process of adjustment. As we remarked in our test report on the 36X R/C two years ago, the 4-A was not difficult to setup if

# Fox 40 R/C


**Two-needle carburetor is simple to adjust.**
**Engine's long mounting lugs for firm support.**

one followed the correct sequence of adjustments but, apparently, the idea of having to tackle three needle-valves was just too much for some modelers.

In the new carb, Duke Fox has therefore eliminated the separate needle valve for adjusting mixture strength at intermediate speeds.
This is now taken care of automatically.
The system of operation is as follows.

1. Fuel is fed to the engine via an inlet nipple cast into the front of the carburetor body. From here it takes two routes:

(a) Fuel for the low-speed mixture is conveyed to an idling jet drilled directly into the carburetor throat and the amount metered through this is controlled by a small needle screw at the front on the right hand side of the carb.

(b) Fuel for the main jet flows through a delivery hole in the carburetor body, well over to the left side, where it is picked up by a hole in the surface of the throttle rotor and conveyed into the interior of the rotor. From here it is discharged through the main jet located in the bottom of the rotor. The amount of fuel metered to this jet at full throttle is controlled in the usual way by a needle-valve, the needle screw being fitted in the left hand end of the throttle barrel.

2. (a) When the throttle is partly closed, the hole in the throttle rotor is no longer exactly aligned with the delivery passage. However, a thin slot in the surface of the rotor, extending from the hole, allows a reduced quantity of fuel to be admitted into the rotor, thereby automatic-ally adjusting the fuel strength to intermediate throttle openings.

(b) Further rotation of the throttle rotor toward the closed position cuts off the fuel to the main jet entirely so that the engine now runs on its idling jet only.

For a standard, non-racing type 40, the Fox has an unusually large choke area. The throat bore is 9.8 mm. which, after allowing for the 4.8 mm. wide flat center section of the throttle rotor, gives an effective choke area of approximately 30 sq. mm. However, the actual intake area is smaller than this as the mouth of the carb is fitted with an aluminum cap having a 5.6 mm. dia. hole i.e. 24.6 sq. mm. cross sectional area.

The carburetor body is of pressure die-cast aluminum alloy and is scaled into the engine crankcase with aluminum-filled epoxy adhesive. The throttle rotor is of steel, finely finished and closely fitted to the carb body to ensure leak-free operation of fuel transfer between the two components.

The carburetor throttle is linked to an exhaust restrictor valve. Unlike previous Fox R/C engines, the valve is of the semi- rotary type, machined from aluminum bar stock and installed within the exhaust stack which is extended for this purpose. A short wire link connects the exhaust valve to a die-cast aluminum arm secured to the solid end of the throttle rotor by means of a 1/4 in. hex nut. This arm has two short additional arms that set the limits of throttle travel, full-throttle and idle, the latter being equipped with a screw adjustment.

According to Fox literature, the 40, having a lapped piston and bronze bushing, may require a considerable amount of running to bring it up to peak performance. On our sample, the bearing was quite free but, having noted that the piston did not have the top relief of the 36 and was fairly tight at the top of the stroke we suspected that a long and tedious break-in might be necessary before the engine could be fully leaned out. In fact, by using a straight three to one methanol

and castor oil fuel mix without nitro, our engine took less than 30 minutes (in two minute runs) of slightly rich operation on a 10 x 6 prop to reach the point where it would stand a fully leaned out continuous run on a 5 percent nitro fuel. However, to further free the engine, we then ran about 20 tanks of fuel through it.

The engine was now holding steady on a 25 percent nitro fuel and was judged to be sufficiently broken in for test purposes. At this point on Fox Missile-Mist fuel, it was turning 10.800 rpm on an 11 x 6 Power Prop Super M, 11.300 on an 11 x 5 Power Prop, 11.900 on an 11 x 4 Top Flite, 11.500 on a 10 x 6 Top Flite Super M and 12.600 rpm on a 9 x 6 Top Flite Super M.

A series of torque and rpm readings were then taken on our standard 5 per cent nitro test fuel, followed by a second series using Missile-Mist. These indicated that (so far as our test sample was concerned) there was nothing to be gained by propping the 40 for speeds above about 12.000 rpm. Maximum torque was recorded at 8.000 - 9.000 rpm and the engine delivered its most useful power output when loaded for speeds between 10.000 and 12.000 rpm. The manufacturer's instruction leaflet suggests a 10 x 6 prop and our findings indicate that this is just about right for releasing the engine's maximum performance on cither fuel. In other words, we would expect that, in a model, the 40 would pick up to rpm figures, in level flight, that arc close to its peaking speed making due allowance, of course, for the fact that different 10 x 6's may vary up to 500 rpm or even more, in power absorption.

The Fox was not at all critical to fuel mixture. As already stated, it was broken in, initially, on a straight methanol castor mix and was subsequently tested on 5% and 20 - 25% nitro fuels. It ran well on all of them. Naturally, it was most powerful on the higher nitro percentages and, as the graph shows, Missile Mist added 12 - 15% more power. As regards handling, the 40 did not restart hot so rapidly as some Foxes we have tested but always started easily enough from cold which, after all, is what matters most. The needle-valve, being close to the prop, needs careful handling if one is to avoid getting one's knuckles rapped.

We have no complaints about the throttle. We do not know whether these engines have the idle needle specially adjusted to an estimated setting before they leave the factory but it so happened that on our example, the setting as received (one turn open) was just about right. In any case, the optimum setting was not critical. Only the idle stop screw required adjustment. As delivered, the engine was idling at about 4.000 rpm on a 10 x 6. Slackening off the idle stop screw brought this down to 2.500 rpm without need of readjustment to the idle mixture. Midrange throttle response was equally good and the mixture strength appeared to be quite well-matched to the whole range of throttle movements between idle and full speed.

In marked contrast to many manufacturers, whose policy is to discourage the purchaser from attempting to service his own engine, Fox approves the idea of the user undertaking his own repairs and will not penalize him in any way if he is unsuccessful and eventually has to send his motor back to the factory.

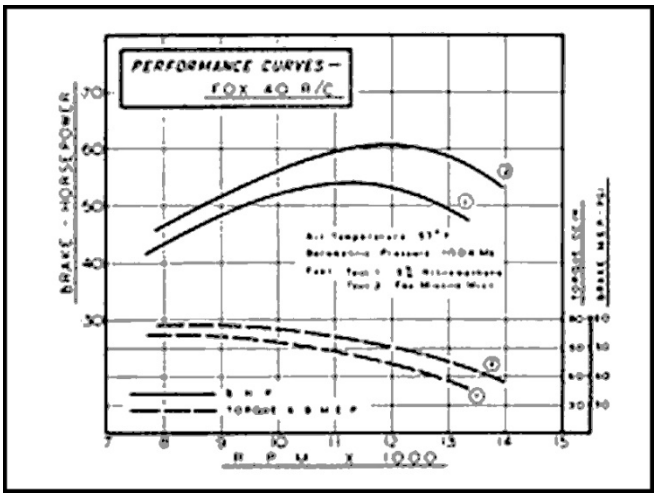
Helpful here is the fact that Fox engines can be taken apart and reassembled with ordinary tools. We have mixed feelings though, about the suggestion, also contained in the instruction leaflet, that the user may hand lap the piston and cylinder or hone the bearing of a tight motor or make minor modifications to the throttle if the intermediate mixture is either too rich or too lean. As the manufacturer rightly points out, such alterations should be carried out with extreme caution. We would go further and recommend that if the owner has a limited knowledge of model engines and has never previously tackled anything of this nature, he should first seek advice as to the precise implications of the work intended and the best way of going about it, from a friend known to be experienced in such matters.

To sum up our findings, the new Fox 40 R/C is a sturdily made engine of good all round

performance. The throttle is effective and easy to adjust and the engine's construction makes do-it-yourself replacement of parts a simple matter. The engine's basic design and construction would also appear to have distinct possibilities for future development (for example, a more fancy combustion chamber shape and a bigger rotary-valve port) for more power.

## Summary of Data

**Type:** Single cylinder two stroke cycle with crankshaft rotary valve and bronze bushed main bearing. Throttle type carburator with coupled exhaust restrictor.
**Checked Weight:** 10.37 oz.
**Displacement:** 0.3971 cu. in. (6.507 c.c.)
**Bore:** 0.800 in.
**Stroke:** 0.790 in.
**Stroke/Bore Ratio:** 0.9875 : 1.
**Specific Output (as tested without muffler):**
1.36bhp/cu. in. (5% nitromethane fuel).
1.53 bhp/cu. in. (Fox Missile Mist fuel).

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